E. J. BUTLER

EMPIRE COTTON GROWING CORPORATION.

REPORT OF THE ADMINISTRATIVE COUNCIL OF THE CORPORATION SUBMITTED TO THE THIRTEENTH ANNUAL GENERAL MEETING ON JUNE 14th, 1934.

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EMPIRE COTTON GROWING CORPORATION.

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FOR THE SEASON

1932-1933.

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EMPIRE COTTON GROWING CORPORATION.

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While it cannot unfortunately be said that the past year has brought any relief to the depression from which the cotton industry in this country has suffered for the past decade, it has at all events served to indicate the possibility that Lancashire may find it advantageous in the future to draw upon Empire resources for an increasing proportion of her requirements of raw cotton.

Last year we were able to report a record crop from the more recently developed Empire cotton fields (*i.e.*, not including India). This year that record has been surpassed, and the output from those countries has reached half a million bales. At present this figure still represents only a very small proportion of the world's cotton crops, but the future holds possibilities which may well become of importance. In 1932-33 the American crop amounted to roughly 55 per cent. of the world's crops, and this season, though that crop is itself very slightly larger than that of 1932-33, the cotton crops in the other comparatively large

producing countries showed considerable increases, with the result that the American crop is only likely to account for just half of the world's supply in the season 1933-34. Neither the immediate nor ultimate effect on world supplies of the Cotton Restriction Scheme in the United States are matters on which anyone will care to prophesy. World confusion renders such a task impossible. The only possible policy is for the Corporation to pursue its work.

Apart from the possibility of increased Empire supplies of American-type cotton, there are prospects of a greater consumption in Lancashire of Indian cotton. The efforts that are being made to promote this object have been fully described elsewhere, but it may be recorded here with satisfaction that in the official estimate of this year's Indian crop, the increase over last year's figure is due entirely to larger crops of the longer stapled varieties.

If our hopes are realised and the Indian and other Empire growths form a steadily increasing proportion of the world's supplies in the near future, it is incumbent on the Corporation to spare no effort to secure that their quantity is, so far as possible, adequate, and their quality in every respect suited to the increased demands that Lancashire may make on them to meet her requirements.

The table of Empire crops at the end of the Report shows that the total production for 1932-33 beat last year's record, and for the first time exceeded half a million bales: examination of the details brings out some interesting points. Firstly, the Sudan crop is down by nearly 100,000 bales—a fall of over 40 per cent. The principal contributing causes are alluded to in the Report; the climatic conditions were unfavourable generally, largely, it is believed, on account of the heavy rains at and before planting time, but the direct

effect of rains at this time on the plants in their later stages still remains to be discovered. Secondly, as a counterbalance to the drop in the Sudan crop, Uganda reports a corresponding increase of over 40 per cent., an additional 87,000 bales.

In the next place, it is interesting to note that generally, in those countries in which decreases have to be recorded, e.g., South Africa—special causes were operating. In South Africa, where cotton is grown by white farmers, the extremely low prices prevailing at planting time made it practically impossible for it to be grown at a profit, having regard to the high costs of production compared with those of the crop produced by natives on their own small holdings.

In the West Indies, there was general agreement among the cotton-growing Islands to curtail their acreage, owing to the difficulty experienced in finding a market for Sea Island, of which stocks from previous seasons remained unsold in this country on account of the small demand for this high-class speciality.

Other features of the table are the steady recovery in the output from Tanganyika, and the increase in the Nigerian crop, which is as striking as was its drop in the last two seasons.

Queensland also has recovered to approximately its production of three years ago. There the Government bounty is probably an important factor in deciding the acreage planted, though naturally it is mainly the weather which determines the yield which that acreage will give. In spite of a difficult season, the yield was considerably higher than that of the previous year, and the acreage was also increased.

The various means whereby the Corporation are endeavouring to assist cotton production are gradually being extended. In the early years, the first requirement was to strengthen the Agricultural Departments of many of the existing or potential cotton-growing parts of the Empire. This the Corporation endeavoured to achieve by building up a staff of their own and by providing for the advanced training of specialists and agriculturists to be attached to one or other of the Colonial Departments of Agriculture. The Corporation paid the salaries of these supplementary officers for the first few years, and they were then absorbed into the regular Departmental establishments. Thanks to the adoption by the Colonial Office of a scheme of Agricultural Scholarships on the same general lines as those of the Studentships by means of which the Corporation trained their own junior staff, the quality of the personnel of the Government Agricultural Departments has been strengthened, and the great majority have now passed through the specialised course of training which the Agricultural Scholarship Scheme provides.

In addition, by this time the agricultural requirements of cotton as a crop, and the problems associated with its cultivation, have been more fully worked out, and their nature is now generally recognised, although they are still far from being solved.

As a result of these two factors, the Corporation feel that, so far as the provision by them of additional funds can aid in the solution of problems bearing on the development of cotton cultivation, many of the Agricultural Departments are now sufficiently well staffed to be able to apply those funds to the best advantage. In certain recent instances, therefore, when the Corporation have been approached to

assist a definite scheme for the development of cotton-growing, they have agreed, if they approve the scheme after careful examination of its details, to provide part of the expenditure that the scheme involves, for a definite period of years, in the form of a grant to the Government concerned, subject only, as a rule, firstly to an undertaking by the Government that they will not reduce their own expenditure on cotton during the period; and, secondly, to the receipt of progress reports, and to the right of periodic visits of inspection by senior members of the Corporation's expert staff. Where this policy is practicable, it obviates the many disadvantages of control divided between the Corporation and the local Department of Agriculture. Risk of friction is avoided, and at the same time it is secured that whatever may be the scheme for assisting cotton-growing that the Corporation are helping falls into its place as an integral part of the whole agricultural policy of the country in question. To this point the Corporation attach considerable importance; they hold the view that the extension and improvement of cotton-growing cannot have a normal and healthy development if it is merely an agricultural tour de force, but can only fully succeed if the crop can be included economically in whatever balanced rotation those responsible for the agriculture of the country are satisfied is that best suited to local conditions and calculated to improve the position of the cultivators. The Corporation naturally are concerned to see that the assistance they give is used to the best advantage, but they are satisfied that, in those cases in which they have felt justified in adopting this new policy, this point is secured by the safeguards regarding inspection and report for which they have stipulated. Should differences of opinion not be capable of adjustment, they can be referred to Mr. Stockdale, the Agricultural Adviser to the Secretary of State for the Colonies.

Personnel.

The term of office of the President and Vice-Presidents of the Council expired last year, and they were re-elected for a further period of three years. This year the non-official members of Council completed the period of three years which is the maximum for which they can hold office under the By-Laws without retiring and submitting themselves for re-appointment. The several bodies having the right of nominating members of Council under the terms of the Charter were accordingly asked whether they wished to re-nominate their present representatives, or to make fresh appointments. In nearly every case the present representatives have been re-appointed, and the changes in the personnel of the Council will accordingly be few.

The Corporation have to record with regret the death last year of Mr. R. P. Scott, who was the representative on Council of the Bombay Chamber of Commerce.

During the past year the Council have been glad to tender their congratulations to the following members whose names have appeared in the Honours Lists:—The Right Honourable Lord Stanley, P.C., Sir Harry Lindsay, K.C.I.E., and Sir Percy Ashley, K.B.E. They have also recorded with pleasure their appreciation of the honour done to the Director, Sir James Currie, in his promotion to K.C.M.G.; to Sir Geoffrey Evans, Controller of the Corporation's Research Station in Trinidad and Principal of the Imperial College of Tropical Agriculture, who received the honour of Knighthood; and to Professor Ballou, who for many years held the posts of Commissioner of Agriculture for the West Indies and Professor of Entomology at the Imperial College of Tropical Agriculture, who received the decoration of C.B.E. on his retirement.

Mr. H. W. Lee has been appointed as the second representative on the Board of Trustees of the Federation of Master Cotton Spinners' Associations, in place of the late Mr. Howarth.

Levy.

Shortly after the last Report was written, the Cotton Industry Act, 1933, passed through all its stages in Parliament. This Act, which replaces the Act of 1928, fixes the rate of the Spinners' Levy, the proceeds of which are payable to the Corporation, at 1d. per 500 lbs. of cotton. Under the former Act, the rate of the levy was 3d. per 500 lbs. of cotton, or such less rate as the Corporation, with the approval of the Board of Trade, might fix in respect of any year. Actually the rate of the levy has been fixed at 1d. since 1930, and the new Act makes this the maximum rate for a period of five years.

The warm thanks of the Corporation are due to Lord Derby and to Sir Gerald Hurst, M.P., for their help in piloting the Bill through Parliament, and to Mr. Browett and other officials of the Board of Trade for their assistance in its preparation.

India.

Mention was made last year of the formation of a Committee consisting of representatives of trade organisations in Lancashire, with Sir Richard Jackson as Chairman, whose aim would be to promote the greater use of Indian cotton in this country. During the year this Committee, among its other activities, has been engaged in demonstrating to spinners and manufacturers the possibilities of Indian cotton with a view to its increased use by Lancashire mills.

The Manchester Chamber of Commerce has also issued under the auspices of this Committee a list of spinners who were making, or were prepared to make, yarns composed wholly or in part of Indian cotton. In the circular sent with this list the Chamber pointed out that there was evidence from brokers and spinners of demand for Indian cotton from new quarters, while several merchants who had introduced Indian yarns into their standard lines expressed themselves as being thoroughly satisfied.

Sir Richard Jackson has recently paid a visit to India to see for himself the work that is being done there on the production and marketing of the crop, and to establish personal contact with the Indian Central Cotton Committee. The Committee has also sent a Commissioner to reside in India, in order to maintain contact with Indian cotton-producing interests.

Imports of Indian cotton into the United Kingdom during the last three years have been as follows:—

1931	1,056,828	Centals of 100 lbs.
1932	536,910	
1933	1,098,486	

The Indian Central Cotton Committee continues to press on with its programme for the improvement of cultivation and marketing in all the principal cotton-growing districts in India. Their Technological Laboratory at Matunga, which, in addition to fundamental research on the physical and chemical properties of cotton fibres, has in the past carried out spinning tests and tests on hair characters, has now undertaken similar tests for the trade, a service which is bound to develop and to be greatly appreciated by cultivator, merchant and manufacturer alike. Another recent extension

of the work of the Laboratory is the opening of a Moisture Testing Station, where numerous moisture tests have been made on samples drawn from trade bales.

In the Punjab, much research work has been done in the past on American-type cottons; progress has, however, been hampered by the frequent occurrence of crop failures resulting in reduced yields and inferior qualities of lint. Work is being concentrated, therefore, on the study of improved methods of cultivation which would check these failures, and on the multiplication of such types as have shown resistance to whatever may be their cause. For this work the Indian Central Cotton Committee in August 1933 sanctioned a grant of Rs.1,24,260 to be spread over five years, during which period this problem will be attacked from the agricultural, botanical, entomological, physiological and bio-chemical aspects.

In Sind, in the Sukkur Barrage area, district demonstrations and experiments on the cultivation of improved cottons and the supervision of seed multiplication and distribution have been continued. This work has been going on for some time, and in August 1933 the Indian Central Cotton Committee renewed their grant to enable the work to be carried on for a further period of five years. Agronomic experiments on the best times of sowing, the best space-intervals for planting, on intercultivation, and the green manuring of the cotton crop were continued at the Agricultural Research Station, Sakrand.

With financial help from the Committee also, physiological investigations on the cotton crop in Sind are being continued. This work embraces such problems as the most suitable sowing dates of different varieties of cotton

under conditions of irrigation from the Barrage, the water requirements of the crop, the best methods of distributing irrigation supply, the application of quick-acting nitrogenous manures at critical periods of crop growth, and the factors responsible for the appearance of " red-leaf " in American and Egyptian cottons.

To illustrate the progress now being made with irrigation in India, the following extract from the latest official report will be of interest :—

" During the past ten years the area under cotton cultivation in Sind has averaged slightly over 300,000 acres with an average annual outturn of about 100,000 bales. With the full development of perennial irrigation under the Lloyd Barrage and Canal Systems, it is anticipated that the cotton acreage will expand to 750,000 acres, and may even reach 1,000,000 acres. Four main classes of cotton are being dealt with by the Agricultural Department in Sind, viz. (*a*) Sind deshi, (*b*) Punjab-American cottons, (*c*) imported American cottons, and (*d*) imported Egyptian cottons. Among these four main classes of cottons, which include types suitable for all purposes, the Agricultural Department have evolved by botanical selection improved strains, which, by reason of high outturn per acre, high ginning percentage, or superior quality, appear suitable for extension in general cultivation in the Barrage areas."

The final cotton forecast for the season 1933-34 shows an estimated area of 23,739,000 acres, with a probable production of 4,970,000 bales. Both the area under cultivation and the yield show an improvement over the revised figures of last year, which were 22,125,000 acres and 4,437,000 bales.

Australia.

In the season 1932-33 a greater interest was shown in cotton-growing, and seed sufficient to plant approximately 80,000 acres was issued. The low prices ruling for other agricultural crops and the poor returns received from dairying both caused many farmers to look to cotton with its guaranteed price to help them recoup their losses on other crops in former years.

The total crop amounted to only slightly more than 13,000 bales of 400 lbs., corresponding to rather over 200 lbs. of lint per acre. This low yield was attributable mainly to the lack of sub-soil moisture as a result of droughts in previous years. While the rainfall for the season was a marked improvement on that of the previous year, it was not sufficient to replace the accumulated deficiency of sub-soil moisture; moreover, there were periods of exceptionally high temperatures in January and March at critical periods in the development of the crop, and had one good thoroughly soaking rain occurred in February, much better yields would have been reported generally. Rains in April helped crops that had not been too severely checked, and the first killing frost did not occur until the third week in June. The total crop was consequently greater than might have been anticipated earlier in the season.

The crop was financed from a joint fund operated by the Federal and State Governments, loans being made at a low rate of interest, and in spite of the disastrous conditions of the season, it is reported that practically all the loans will be liquidated.

Much interesting work continued to be carried out at the Research Station at Biloela, among the points investigated being the effect of different rotations and cultural methods on the supplies of sub-soil moisture, and the reasons for the higher yields of cotton obtained from land only recently brought under cultivation as compared with land that had been under crop for many years.

The expansion of the spinning industry in Australia has necessitated investigation into a wider range of varieties than had been studied previously, with a view to providing the type of cotton required by the local mills. During the past few seasons the climatic conditions have seriously affected the results obtained, and the varietal tests are being continued.

At the beginning of the current season excellent rains were obtained, and the new crop was planted under more propitious conditions than for many seasons past. Subsequently a month's dry weather caused extensive shedding and checked the crop prospects in many parts of the country. In February it was reported that a good recovery was taking place, and it was expected that the crop would considerably exceed last year's.

A feature of this season has been the planting of approximately 6,000 acres of varieties having a lint length of from 1 inch to 1⅛ inches and a ginning outturn of between 35 per cent. and 40 per cent. It is expected that a large area of these types will be planted next season. The increased return per acre which it is anticipated will be obtained from these varieties with higher ginning outturn and heavy yielding capacity will, it is hoped, act as an offset to the reduction in bounties which takes place each season until the bounty expires altogether in 1936.

South Africa.

The causes which have led to so marked a reduction in the acreage planted to cotton in the Union of South Africa during the past few years still operated last season, the low prices prevailing at planting time being probably the chief deterrent. Indeed, as Mr. Milligan pointed out in his introductory note in the Corporation's volume of Reports from Experiment Stations, cotton-growing in the Low Veld would have been entirely impossible at those prices had it not been for the valuable properties possessed by U.4 cotton bred at the Station at Barberton. The resistance to jassid possessed by this strain and its power of recovery from bollworm attack have alone led to the continuance of the crop in that area.

At the time when the last Report was written, South Africa was suffering from the worst drought for 30 years: practically no cotton had been planted in the Middle Veld, and the area in the Low Veld had been much reduced. At the same time, periodical droughts have led farmers to turn their attention more towards cotton, recent experience having shown them that that crop stood up to drought conditions better than any other, and it is expected that this season may see an expansion, in view of the slight increase in prices about planting time. Although little cotton was grown under irrigation last season, excellent early yields were obtained. The phenomenal prosperity of gold mining will apparently render possible large expenditure on water conservation all through the Union, so that the question of cotton-growing under irrigation conditions is likely to loom largely during the next few years.

The Corporation's Experiment Stations in South Africa issued this year a general report on their work during the past three years. In that report reference is made to the

fact that the unselected U.4 type is now practically the only cotton grown in the Low Veld. Re-selections will be issued later: they have been severely tested in the past few years under drought conditions, but it is desirable that experience should be gained as to their behaviour in years of heavy rainfall before a final decision can be reached as to which will be the best all-round strain for the District.

The Stations are also devoting their attention to many problems bearing on general farming practice, and to experiments designed to test which are the best rotation crops for cotton. Samples of many of the crops tried, such as beans and sunflowers, have been sent home for analysis and report. In this connection the warm thanks of the Corporation are due to the Imperial Institute for their co-operation in reporting on the food value or oil content of the samples sent home, and for obtaining the views of the trade as to their market value.

Possible means of controlling insect pests constitute one of the most important, and at the same time most difficult, problems connected with cotton-growing, not only in South Africa but in many other parts. In the Report last year mention was made of Mr. Milligan's suggestions for the extension of the work that had been carried out on this problem during the last few years. The Executive Committee carefully considered the details of the proposals and sanctioned the expenditure involved. More detailed and systematic records will now be possible at all Stations, with a view to finding out which are the crops particularly favoured by the different pests when they are not in cotton, and other facts concerning their life histories throughout the whole of the season. A scheme has been worked out which will be followed generally at the Stations in South Africa and in Southern and Northern Rhodesia, in the hope that

the collection and comparison of records of the pests in different parts of the country and throughout the season may provide information sufficient to enable some scheme to be devised for their control. Certain promising lines of attack are already indicated. Close contact in this work will be maintained between the two Stations in the Union, the Station in Swaziland, and those in Southern and Northern Rhodesia.

The Department of Agriculture report that this season the improvement in prices and in trade generally encouraged farmers to plant a larger acreage, and conditions were favourable at planting time.

In the Barberton area planting conditions were better than they have been for several seasons. Partly as a result of this and partly owing to the expectation of better prices, with no loss on exchange, the cotton acreage in this district was about 50 per cent. greater than that of the previous season. Most of the increase was due to the planting of cotton by farmers who had not grown any for the past few years. The crops generally were in excellent condition by the end of January, but American bollworm took a heavy toll during February. That month was also very dry, and, writing in March, Mr. Parnell said that light crops were to be expected in the area generally.

At the Experiment Station also the crop made an excellent start. At the end of January the records of the Insect Pest Control Section showed a sudden very heavy egg-laying of American bollworm on cotton: immediate steps were taken to dust the most important areas with calcium arsenate, but there was some delay in obtaining extra dusters and a sufficient quantity of poison. Eventually,

however, the whole of the selections and variety trials were treated between February 1st and 12th. The result was very satisfactory on the areas first dusted, where the greater part of the crop was saved; on the latest dustings little of the set crop was saved, but the bulk of the squares was retained, and flowering continued vigorously. Where no dusting was done, the plants were completely denuded of bolls and squares, and flowering stopped completely pending the production of an entirely new flush. Had it not been for the timely warning afforded by the egg-laying records, the bulk of the season's cotton work would have been ruined. As it is, the crop is fairly good on much of the area of the selections, and even the latest dusted variety trials should give some useful results.

In the Magut district in Natal, the season also began well, though rather late, with rather too much rain in November and December. As at Barberton, there was a very heavy infestation of American bollworm in February, and heavy losses of a large potential crop resulted. Egg-laying by locusts also took place in January, but the situation is thought by the Division of Entomology of the Union Government to be well in hand locally. The multiplication of the various strains under test is reported to be satisfactory.

Swaziland.

The acreage under cotton was again reduced, owing partly to the low prices obtainable and partly to climate. After the previous year's drought, the working cattle were in poor condition, which prevented early ploughing, while the spring rains were delayed.

At the Corporation's Experiment Stations the conditions were again better than in some parts of the country at the beginning of the season. The planting rains at

Bremersdorp were favourable, and enabled the crop to make a good start, but unfortunately all the experiments were destroyed by a hail-storm early in December. They were re-planted as soon as possible, but fared no better, as a sequence of dust-storms towards the end of the month again wiped out everything. The season was, however, still early enough for crops other than cotton, and useful experiments were carried out on rotation crops, from which high yields were obtained.

At Nsoko some experiments were again planted out on the irrigated area. In view of the losses by boll rot in previous seasons, irrigation was confined to a heavy watering before planting, so as to create a reserve moisture. The rainfall was low, but the cotton crop did well and the average yield was over 800 lbs. seed cotton per acre. Though stainers were present as in other years, boll rot infection was only slight.

Increased interest is being taken in the cultivation of cotton by natives. This season instructional plots were planted to illustrate the best methods of cultivation and general handling of the crops. These were worked by the natives themselves, and the necessary instruction given by trained natives employed by the Corporation. Considerable interest has been aroused in the country, and some thirty natives have applied for seed for planting in the current season. If the crop is taken up, it will be of great value to the native, not only as a welcome cash crop, but as being the means of introducing a system of crop rotation, and thus improving the native system of agriculture.

In the season 1933-34 the acreage under cotton was approximately the same as that of last season. Good early rains were general, and a satisfactory growing period was

experienced in most districts. There was a heavy infestation of the crop by American bollworm in mid-February, the extent of which it was impossible to estimate when the Report was written. At the Experiment Station at Ingwavuma planting conditions were excellent, but a hail-storm at the end of November necessitated re-planting. Damage by beetle and a dust-storm in December unfortunately destroyed the experiments; some of these had again been duplicated, however, at Nsoko, where satisfactory conditions were experienced. Unfortunately there was a risk in March of extensive damage by locusts in that area.

Southern Rhodesia.

Here, as in South Africa, owing to the low prices ruling about planting time, the acreage in the season 1932-33 was disappointingly small, and the crop amounted to only 355 bales of 400 lbs. But, as Major Cameron writes, "Although cotton has scarcely secured more than a foothold in the agricultural economy of the Colony, it is slowly dawning upon farmers and others that it has held on by virtue of its own merits, unassisted by bounties, controls and other subsidy measures."

The Cotton Breeding Station at Gatooma experienced a bad season climatically. The total seasonal rainfall amounted to nearly 30 inches, but its distribution was bad. Planting rains were late, and dry weather in December delayed the crop. The rains were heavy from the end of that month until the end of January, and this checked the crop further. Moreover, they ceased by the end of February, so that the season was practically one of drought, with only a short growing period.

However, the conditions were favourable for a further sorting out of the most hardy and successful strains.

Selections from U.4 cotton bred at Gatooma, and subsequently grown under observation in the principal cotton-growing districts, are now the only types grown in the country.

The effect of jassid was not very noticeable owing to the resistant qualities of the U.4 selections, but if any of the susceptible varieties formerly grown had been cultivated they would have suffered severely. Towards the end of the season, when the drought became intensified, locusts were attracted to cotton, stripping bark off the stems and branches.

The Co-operative Ginnery at Bindura and the Central Ginnery at Salisbury were the only two in operation. Early in the season the former reduced its charges from 1½d. to 1d. per lb. as an inducement to farmers to plant more cotton in the following year.

The investigations on insect pests, that have been carried out for several years at the Station, were continued, and included more detailed investigations both of American bollworm and of stainers. The results so far obtained in connection with the use of maize as a possible counter-attraction for bollworm moths are similar to those recorded at the Corporation's station at Barberton. They have been described in detail in the Rhodesia Agricultural Journal for the information of cotton growers; it has wisely been pointed out at the same time that only experience over a few years can show what degree of control will be provided by the measures described. As has been mentioned above, under South Africa, arrangements have been made to co-ordinate as closely as possible the insect pest work in the Union of South Africa and in Southern and Northern Rhodesia, and the funds allocated by the Corporation for this purpose have

enabled a better trained type of native to be employed for recording in the districts, and more detailed work of this kind to be carried out at Gatooma in the present season.

There are indications that a native cotton-growing industry may eventually be established. In its early stages such an expansion will of necessity be slow, but Major Cameron is of opinion that the feeling in its favour is growing, and that the view is now more widely held that both the natives and the European farmers alike will benefit from any movement which will provide the former with another crop that has a world market. For the first year the experiment has been limited to demonstration plots in suitable areas, supervised by natives. Should the industry progress, it will be necessary to make arrangements for the purchase of the crop.

In the season 1933-34, there was a slight increase in the acreage under cotton. Doubtless the continued low price of maize has been a factor in leading farmers to investigate the possibilities of other crops. The prospects of a profitable return from cotton have been assisted also by the action of the Bindura ginnery in reducing its charges. In certain areas, cotton undoubtedly offers an alternative cash crop to maize. It has also been established that cattle may with advantage be grazed on the plants after the crop has been picked.

Writing in the middle of February, Major Cameron said that the current season's cotton crop looked promising in most parts of the country, while at the Experiment Station at Gatooma, it was the best that had ever been grown there. He pointed out, however, that the usual bollworm attack does not develop until later, and it was impossible to say what its effects would be.

Northern Rhodesia.

During the past year, the Government of Northern Rhodesia decided, as a measure of economy, to make drastic retrenchments at the Mazabuka Agricultural Research Station. It is understood that the scope of its work will be so far restricted at present that no formal agricultural experimentation will be carried out there during the present year. On learning of the intention of the Government to take this step, the Corporation put forward as strong a plea as possible for the retention of the work of the Station, which in their view is vital to the agriculture of the country. Without the experimental results from Mazabuka, the work that is being carried out assiduously by the District Agricultural Officers, with a view to developing native agriculture, may suffer. Moreover, it is feared that the value of the ecological survey, which is being undertaken with the assistance of funds provided from the Colonial Development Fund, will be diminished, inasmuch as close co-operation with an agricultural research station is of invaluable assistance in applying the results obtained by the survey. Furthermore, it is hoped that financial conditions in the country will improve, and, in that event, work at Mazabuka must inevitably be resumed sooner or later. When the team of research workers has been dispersed and the continuity of their results interrupted, reconstruction will probably be difficult, slow and costly.

The Corporation's immediate interest in Mazabuka lies in the fact that it forms a link in the chain of experiment stations in Africa at which it is hoped that a closely co-ordinated scheme for the investigation of the insect pests of cotton may be carried out. It is believed that the best hope

of devising means of insect pest control lies in the critical comparison of results obtained from a carefully considered plan of campaign carried out at several different experiment stations under various climatic and soil conditions. On receiving the assurance of the Northern Rhodesian Government that the entomologist at Mazabuka would be retained, the Corporation decided to retain also their own plant breeding officer at that station, in order that the two might continue to participate in this work on insect pest control. The Government state that they are unfortunately unable to contribute towards the cost of the work of the plant breeding officer as they have done in the past, and the whole expense is accordingly being borne by the Corporation for the present year.

The plant breeding officer paid a visit to Barberton at the beginning of the season, in order to familiarise himself with the methods of attack employed at that Station in connection with insect pest problems, and some interesting experiments are being carried out in Northern Rhodesia with a view to gaining information as to the distance that cotton stainers will migrate on to cotton from alternative host plants. The Corporation's plant breeder and the Government entomologist have had the advantage of the co-operation of the Ecological Survey in this piece of work.

In the Fort Jameson district, trials with cotton during the past two years have given satisfactory results, yields of between 600 and 700 lbs. of seed cotton per acre having been obtained from U.4 seed. Unfortunately, owing to the high cost of transport, it is unlikely to be a profitable crop in the district for some years to come, unless prices rise considerably, and the trials have accordingly been discontinued.

Anglo-Egyptian Sudan.

Season 1932-33.—The Director of Agriculture has been good enough to supply the following particulars as to the final yield of cotton from the various districts of production last season :—

TABLE I.

1932-33.

SAKEL TYPE.

	*Feddans.	Yield in †Kantars.	Yield per Feddan in Kantars.	Calculated as bales of 400 lbs. lint.
GEZIRA.				
Sudan Plantations Syndicate Ltd. ...	175,792	336,322	1·91	79,876
Kassala Cotton Co.	19,183	39,154	2·04	9,299
Total ...	194,975	375,476	—	89,175
TOKAR	44,000	95,513	2·17	22,684
GASH DELTA (Kassala) ...	19,147	27,120	1·41	6,441
PUMPING SCHEMES	3,956	11,057	2·79	2,626
Total Sakel	262,078	509,166	—	120,926

AMERICAN TYPE.

	*Feddans.	Yield in †Kantars.	Yield per Feddan in Kantars.	Calculated as bales of 400 lbs. lint.
IRRIGATED.				
Pumping Schemes ...	11,635	39,569	3·40	8,903
RAIN GROWN.				
Kordofan (Nuba Mountains) ...	32,000	26,225	0·82	5,900
Upper Nile...	1,800	2,761	1·53	621
Mongalla ...	9,425	4,579	0·48	1,034
Total American ...	54,860	73,134	—	16,458

* 1 Feddan=1·038 acres. † 1 Kantar=312 lbs. seed cotton.

In the Gezira the 1932-33 crop was planted under unfavourable conditions of heavy rains, and a considerable area was of necessity late sown in consequence. All the steps described in last year's Report were taken to minimise damage from Blackarm and Leaf Curl : imported Egyptian Sakel seed was used which, before it entered the Gezira, was sunned and dusted with a germicidal powder. A very thorough clean up of ratoons and volunteer seedlings was also carried out. In spite of these precautions, much damage was done both by Blackarm and by Leaf Curl, and the final yield was slightly under 2 kantars per feddan on an area of 194,975 feddans (acres). This compares with a yield of over 4 kantars per feddan in 1931-32, and an average of 3.27 kantars over the 8 years since irrigation from the Dam became possible. It is believed that climatic conditions and not disease are the main factors affecting the yield, particularly rainfall. The rainfall records give reason, however, for anticipating that the recent years of abnormally heavy rains are likely to be followed by years of lighter precipitation.

Investigations into the causes of the fluctuations in yield naturally continue to take the outstanding place in the work of the Gezira Agricultural Research Service under Mr. Bailey. The manner in which variations in climate and particularly rainfall affect the yield has still to be discovered, but suggestions have been made by the Research Service that it may be found to be connected with aeration of the soil and the extent to which its normal cracking, both vertically and horizontally, is interfered with by early rains.

The Plant Breeding Section have made a most important contribution to the solution of one of the main problems—Leaf Curl—by their success in breeding new strains which

are highly resistant to this disease. One of these new strains, developed from a selection originally made from Sakel and sent in to the Section, gave more than double the yield of Sakel when grown alongside it in the Gezira. This increase in yield is attributable partly to the inherent capability of the strain to resist unfavourable growth conditions (a feature which characterised the original selection) and partly to the very marked resistance to Leaf Curl which has since been developed in this strain. Consequently there are good grounds for believing that when this seed is available in bulk, satisfactory yields will be obtainable even in seasons in which the conditions are climatically unfavourable. It is hoped that a sufficient quantity of the seed will be available to plant the whole of the Gezira in the season 1935-36. It was propagated this season in a part of the Gezira in which it was believed that it should be out of the way of severe rain storms. Unfortunately, it received a deluge of 5 inches shortly after it was planted; 150 acres of the young plants disappeared entirely, and the rest was badly damaged. However, despite these misfortunes, it is anticipated that its yield will still be greater than that of the Sakel Main Crop, which did not receive the same set-back. The quality of the lint of the new strain has been favourably reported on in Lancashire.

As regards Blackarm, this was not as serious as in some previous years, but was severe in places. No instance of " primary " infection was recorded, and this is believed to have been due to the preventive measures which were taken. Considerable progress has been made towards discovering how the infection starts and spreads, and there are excellent grounds for thinking that further measures of control can be successfully adopted.

Reference was made in last year's Report to the fact that a four-year rotation was being introduced into the Gezira which, while it would include a fallow immediately before and after cotton, would also include dura, the tenants' food crop. Lubia, the tenants' fodder crop, will also be introduced as soon as the position with regard to pests renders this possible, and this will enable stock to be kept. The new rotation will involve some reduction in the proportion of the gross area which will be under cotton, and some expansion of the irrigated area is contemplated.

Tokar and Kassala crops of 1932-33, in spite of a considerable incidence of Leaf Curl, were again good. Tokar established a new record with 95,513 kantars against the previous best of 72,041 kantars obtained in 1921. In both cases Gash seed from the previous year's crop was sown. The 1933 floods on both these deltas were smaller than those of the preceding year and, though the watered area at Tokar was thereby reduced, successful manipulation of the Gash irrigation works resulted in the flooding of an increased area and promising crops have been established.

A decrease again occurred in the amount of American cotton produced in 1932-33, both in the irrigated and rainfall areas. This is attributed to low prices, to bollworm damage in Berber Province, and to the lack of food crops following the locust attack of the former year. Now that the granaries have been replenished an expansion of the area under cotton has again taken place, and the estimated output is nearly double that of last season.

Season 1933-34.—The following table gives the areas and some indication of the probable yields for the current season :—

TABLE II.

SAKEL TYPE.

	Area Feddans.	Anticipated Yield in Kantars.
GEZIRA.		
Sudan Plantations Syndicate Ltd. ...	155,936	450,000
Kassala Cotton Co.	18,991	
Total ...	174,927	
TOKAR	37,700	35,000
GASH DELTA (Kassala)	31,146	54,500
PUMPING SCHEMES	5,447	16,850
Total Sakel	249,220	556,350

AMERICAN TYPE.

IRRIGATED.		
Pumping Schemes	12,300	53,514
RAIN GROWN.		
Kordofan (Nuba Mountains) ...	47,000	86,302
Upper Nile	2,000	
Mongalla	10,414	
Total American...	71,714	139,816

In the Gezira the 1933-34 cotton was put in under favourable conditions and there was promise of a good crop. Unfortunately exceptionally heavy local rains flooded large areas of promising young cotton, Blackarm made its

appearance and abnormally late rain storms occurred which caused it to spread over large areas. The crop was severely damaged in this way. Fortunately Leaf Curl was almost absent. While this disease appears to be to some extent seasonal, it is probable that its decrease this season has been largely due to the almost complete absence of ratoons which resulted from the pulling up of the cotton stalks of the preceding crop by the roots, by means of hand machines operated by the tenants. The operation of extraction, in place of the former method of cutting, was adopted with a view to reducing the carry-over of Leaf Curl from crop to crop, which is believed to be effected primarily by the transfer of the virus from infected ratoons to the new crop by white fly.

The yield is likely to be somewhat below the average for the years since the area has been under irrigation from the Dam, with a fair proportion of high grade cotton.

Kenya.

The cotton crop of 1932-33 fulfilled expectations, and produced over 3,000 bales, which is a record for the Colony. As stated last year, the crop is grown almost entirely in the Nyanza Province and in the Coast Province. The Agricultural Department are continuing their trials to determine the varieties best suited to the different conditions in the two main growing areas; the varieties that are being tested include strains imported from Nyasaland and from Uganda, together with several selections from U.4 obtained from Tanganyika and originally derived from Barberton. The report from the Coast Province states that the quality of the lint has been much improved by the introduction of new seed.

Intensive propaganda, in which the Administration and the Agricultural Department co-operate, is conducted each year with a view to increasing the production of cotton in the two areas mentioned. The ginners also do their best to stimulate production in their respective areas. The fact that the production has been increased from 1,700 bales in 1931-32 to over 3,000 bales this season, in spite of the low prices that have prevailed, constitutes a testimony to the efficiency and enthusiasm with which this work is carried out.

The prospects for the current season have been materially influenced by the drought in 1933. It is estimated that in the Coast area some 5,000 acres of cotton perished. In the Lake area an attempt was made to extend cotton cultivation in the area bordering the Kavirondo Gulf and the shores of the Lake, but owing to the apathy of the natives, little success has so far been achieved. The final yield should approximate to that of the preceding season.

It is estimated that for the Colony as a whole the output of cotton in the current season will show an appreciable advance over that of last year, and should reach approximately 4,400 bales.

Uganda.

The season 1932-33 saw the production of a record crop, the exports for the year 1933 approaching 295,000 bales. Some loss of crop occurred in Buganda, owing to abnormally heavy rain at the end of January and beginning of February, which caused some rot in the mature bolls; otherwise conditions were generally favourable.

In the last Annual Report, reference was made to the agricultural evils to which the increasing use of motor transport for cotton had given rise in Uganda, such as the risk of mixing different strains, and the danger of carrying

disease. It is consequently a matter of gratification that during the past year the Uganda Government have introduced legislation enabling raw cotton zones to be declared, within which all cotton grown must be ginned and baled. This restriction of movement of raw cotton into or out of any zone is limited to movement by motor lorry : head loads and canoe loads are exempted, as these do not in themselves give rise to the evils which the new law is intended to prevent.

It is further hoped that a secondary effect of the new legislation will be to check the uneconomic competition between ginneries and the extravagant use of motor transport which has been prevalent in Uganda for many years. A Committee has been appointed to advise the Government upon special cases of ginneries situated on the borders of the zones created under the new legislation, and another Committee to advise upon the fixing of prices for raw cotton where necessary, and the maximum charges to be made for the ginning and baling of cotton for middlemen. It is understood that the new legislation will be brought up for review after the first season's working.

While a beginning has thus been made in the establishment of Government control over the cotton industry, further reforms are needed in order to place it on a satisfactory basis. According to the Report of the Department of Agriculture for the year 1932, there are still many ginneries with an outturn of below 1,000 bales per annum, and the Director considers that it is reasonable to visualise a reduction in their number to a point at which each ginnery should have an annual average return of approximately 5,000 bales. He also regards it as equally necessary that substantial reductions in ginning and buying costs should be effected.

The botanical staff of the Department of Agriculture is now working at two principal experiment stations, one in the Eastern Province and the other in Buganda. At each Station active work is going on with a view to breeding the strain most suitable to local conditions. In the Eastern Province a new scheme of seed multiplication and distribution has been introduced, and the average yield of the strain distributed amounted to about 300 lbs. of seed cotton per acre over 30,000 acres. In Buganda the local cotton gave further evidence last season of the need for new seed, and every effort is being made to obtain a suitable strain for distribution as soon as possible. The task is, however, proving none too easy : a variety trial at Bukalasa showed that only one of the varieties tried was superior to the local variety, and that one was susceptible to jassid. There is reason to hope, however, that jassid damage may not be a limiting factor in Buganda. In addition, various new selections have been made, some of which are distinctly promising. They include one U.4 selection from Southern Rhodesia, which has given suitable lint characters.

When it was realised that a type of cotton was needed for Buganda different from that which had been found to be best suited to conditions in the Eastern Province, the Corporation offered to co-operate with the Uganda Government in the staffing and maintenance of a seed farm for the former district. Although the Uganda Government had accepted the suggestion, no steps have hitherto been possible towards the establishment of the seed farm, owing to the difficulty of finding a suitable site. The Government are now of the opinion that this difficulty has been overcome, and they have put forward suggestions for the establishment of a seed farm on an estate which they have purchased a short distance from Kampala. The conditions of co-operation

between the Government and the Corporation are under consideration.

In the season 1933-34 dry weather conditions during May, June and July greatly hindered planting, and a considerable amount of re-sowing was necessary. In spite of adverse weather, a very satisfactory acreage was planted, and the supplying of blanks was very well carried out. The total acreage was 1,090,502 acres, which shows an increase when compared with 1,071,410 acres planted during the previous season. In one district, however, a new computation basis was initiated, and the total figures do not necessarily indicate an actual increase in planting.

Weather conditions in September and October were satisfactory for the crop, but November was dry and affected adversely the late-sown cotton. Rains in the first half of December greatly benefited the later plantings, and prospects improved enormously. Later, hot dry weather was ideal for the ripening of the crop, and the yield should be above the average in many areas.

Blackarm and other diseases and pests have been negligible. The ideal weather during the ripening and picking period greatly improved the grade this season, and there will be very little stained cotton : it is estimated that total production will be not less than 285,000 bales of 400 lbs. each.

Tanganyika Territory.

When the last Annual Report was written, conversations were in progress with the Director of Agriculture with regard to the financial assistance that the Corporation might give to the Department to enable it to carry out the suggestions for the development of cotton-growing that had been made by

Mr. Milligan after his visit to the Territory. The Director of Agriculture estimated that it would cost about £2,000 a year to give effect to Mr. Milligan's recommendations, and he asked if the Corporation would provide one-half of this sum for at all events five years, a request to which the Corporation readily agreed after providing for certain necessary safeguards.

The output from Tanganyika last season continued to show a satisfactory increase, over 28,000 bales having been produced, as compared with 18,039 in 1932.

In the light of the information they have obtained from the Government and from other sources, the Corporation believe that the prospects for developing cotton-growing in Tanganyika are distinctly favourable, and they informed the Director of Agriculture that if he were to submit a scheme with this object, which proved acceptable to the Corporation, they would favourably consider a request to contribute towards the cost of putting it into effect. The Director of Agriculture has recently submitted to the Corporation a Memorandum embodying his views on the means whereby cotton-growing can best be extended in the Territory. He is of opinion that the Lake Province has considerable possibilities, and stresses the need of education of the natives in the use of the plough. Extension of the present small experimental and seed farm in that area is proposed. Provision of a larger area for seed multiplication is also required at Morogoro, where peasant farmers would also be trained—probably more or less on the lines that have been suggested at the Corporation's seed farm at Daudawa in Northern Nigeria. Additional junior staff is also needed at the Experiment Stations at Mpanganya and Lubaga. These proposals are receiving the careful consideration of the Executive Committee.

Varietal tests continue to be carried out at the Government Experiment Stations. U.4 and selections made from it have been distributed for general cultivation in the Shinyanga district, to which it appears well suited. In the Morogoro district, the general conclusion appears to be that the best results will be obtained from selection from the Local strain, the lint of which has so far proved itself superior to that of any imported varieties.

The new Government regulations for zoning the districts came into force in 1933. These aim at overcoming the evils arising from the movement of seed cotton by motor lorry over long distances. Not only does this practice lead to the risk of admixture of seed, but it is not in the best interests of the native producer, who has naturally had the cost of transport deducted from the price he received. Under the new Rules, no unginned cotton may be moved from one administrative district to another without permission. Steps have also been taken to safeguard growers against excessive ginning charges, to reduce the amount of tax taken as Cotton Cess, and by means of a fair price scale, and supervision and check weighing, to protect the native grower against unfairly low returns. Notice has also been given that no new ginneries can be erected until the size of the crop justifies it, but old ginneries may be re-sited.

The increase in the crop last season to over 28,000 bales —an increase of nearly 60 per cent.—is particularly satisfactory in view of the fact that the season cannot be described as having been altogether favourable. In the Lake Province the crop was nearly doubled, and in the Eastern Province it increased by 50 per cent. It is noteworthy that non-native production amounted to about

11 per cent. of the total crop, as compared with 8 per cent. in the previous year. It is hoped that this renewed interest in the crop foreshadows a general improvement in the future.

Generally, a further increase in production throughout the cotton-growing areas of the Territory is anticipated and, with favourable conditions, it is hoped in 1934 to pass the previous record figure for the Territory of 32,000 bales. The seed distribution was greater than in any previous year in the history of the Territory, but as at the time of writing (March) the Territory was suffering from a very heavy infestation of locusts, particularly in the cotton-growing areas, any estimate of production must be regarded as entirely provisional. In fact, if there is any considerable destruction, the cotton production may be seriously menaced.

Nyasaland.

The removal of the Corporation's principal cotton experiment station from Makwapala to Domira Bay, near the South-West corner of Lake Nyasa, has so far been attended with satisfactory results. About 150 acres are now under cultivation at the Station, and this provides for 60 acres of cotton annually for the experiments. The favourable opinion that has been formed as to the suitability for cotton of the land at this Station was confirmed by the fact that over the whole acreage the yield last season amounted to 250 lbs. of lint per acre. These good yields have provided a stock of seed of improved U.4 types which will plant a multiplication area of at least 1,000 acres. This will be planted under controlled conditions by native growers in the Domira Bay area. The necessary buildings on the Station are nearing completion, ginning machinery has kindly been supplied on loan by the British Cotton Growing Association, and

provision has been made for the supply of electricity, and for the completion of the water supply scheme that was mentioned in last year's Report.

Selection work with a view to obtaining improved strains of the U.4 type is being continued and the trials replicated at Domira Bay, Port Herald and Karonga. At the present stage, however, it is thought preferable to issue a mixture of high yielding U.4 types, of similar lint character, rather than separate strains.

Some of the hybrids supplied by Dr. Harland from the Corporation's Research Station, Trinidad, showed a good deal of promise and should provide useful breeding material.

The Station has also been engaged in testing for jassid resistance certain strains supplied by Mr. Trought, the Corporation's plant breeder in the Sudan, who wishes to secure jassid-resistant types for the rainfall areas in the Southern Sudan.

The commercial crop of 1932-33 fell short of the expectations formed early in the season. This was mainly due to locusts. Locusts as a rule prefer food crops to cotton, and the resulting loss of crop is often due not so much to direct damage to cotton plants as to the fact that the natives, fearing for their food supplies, naturally devote more attention to them than to their cotton. At the same time, quite an appreciable amount of direct damage by locusts was reported last year from the Domira Bay Station; about half the plants were barked, and this resulted in much boll shedding. Fortunately, the attack took place at the end of the season, when the bolls were ripe and the weather dry, so that a good deal of the shed material could be harvested.

In spite of adverse factors, however, the total Nyasaland crop exceeded that of the previous year by about 18 per cent.

Seed of the U.4 type was available for the current season's sowings for the whole country, and seed issues have been considerably increased, especially in the districts adjacent to the Northern extension of the railway. The Department of Agriculture have done much to interest natives living in this area in the economic value of cotton and other exportable crops. In preparation for loss of crops from locusts, Mr. Ducker held back a good reserve of seed in case it was needed for replanting.

Nigeria.

Exports of cotton for the season 1932-33 exceeded 24,000 bales, and thus showed, as was anticipated, a marked recovery from the low figure of only 6,268 bales for the previous season. The desire to grow more cotton is attributed largely to the fact that the reduction in the locust menace rendered unlikely any serious food shortage in the near future. In the Northern Provinces, the ratio of the number of bales purchased to the number of tons of seed distributed was the highest on record, and indicates that practically all the seed must have been planted. In the Southern Provinces, the output of Ishan cotton was again disappointingly small: possibly this was brought about by the fact that the weather was exceptionally dry at the normal planting time, and any farmer who missed the first opportunity to plant on the one rain that occurred at that time, lost his only chance.

At the Corporation's seed farm at Daudawa, in the Northern Provinces, the Agricultural Department's selection from Allen cotton, known as Strain L, was grown on 260 acres. At the beginning of the season the crop looked very promising, but owing to shortage of rain later the crop fell

short of expectations, and only yielded 236 lbs. of seed cotton per acre, which was about the same average as that of the ordinary Allen cotton at the Station. Strain L was given what is normally the optimum planting period, but in the season 1932-33 this turned out less favourable owing to shortage of rain in July. Taking this fact into consideration, the special strain was considered to have shown up well, and is the only type that has been multiplied at Daudawa in the season 1933-34.

The Botanical Section of the Department of Agriculture have come to the conclusion that neither selection work on Allen nor the introduction of exotic varieties is likely alone to produce an improved type suitable to local conditions. They have therefore started on a programme of hybridisation, using as parent material two Allen selections, a variety of Hartsville from the United States, and a selection from U.4 from Southern Rhodesia.

In the Southern Provinces the botanists are continuing their breeding work on Ishan with the object of eliminating the roughness of the lint. Hybridisation has been carried out between two Ishan strains, and also, on Dr. Harland's advice, between Ishan and Sea Island. Similar crosses are also being made for the Nigerian Government at the Corporation's Station in St. Vincent, and other crosses made in St. Vincent have been sent to Nigeria for trial next season.

In the last Annual Report reference was made to suggestions that had been received from the Director of Agriculture to extend the function of the Seed Farm at Daudawa, Northern Provinces, by carrying out there trials of various rotations and methods of intensive cropping, as well as the multiplication of cotton seed. The Director of Agriculture further submitted suggestions for the utilisation

of part of the land already cleared at Daudawa for the purpose of a tenant farmers' scheme. It was mentioned also that Mr. H. C. Jefferys had been appointed to visit Nigeria to investigate these proposals in consultation with Government representatives on the spot. It may be convenient to summarise here the principal points in Mr. Jefferys' report, which were also set out in the Executive Committee's Quarterly Report to Council in January last.

Mr. Jefferys agrees that arrangements should be made whereby the Department of Agriculture can make wider use of the Seed Farm in connection with their policy for the development of animal husbandry in Northern Nigeria. In the extension of this system of mixed farming, Mr. Jefferys sees the only hope for such agricultural development in the Northern Provinces as can lead to any considerable increase in the amount of cotton produced for export. He recommends, therefore, that 400 acres at Daudawa should be reserved for the main purpose of the multiplication of cotton seed, and that the closest collaboration should be maintained with the Department of Agriculture, so that, in addition, the farm should be rendered available for such large-scale trials as will not interfere with the main work of seed multiplication and are within the capacity of the existing staff to carry out. To this recommendation he attaches two conditions, namely, (i) that the cost to the Corporation shall not thereby be increased, and (ii) that the Department of Agriculture shall undertake to supply all necessary technical assistance for experimental work.

Mr. Jefferys further recommends that the remaining 500 acres of land already cleared should be devoted to the development of a mixed farming settlement scheme. It is suggested that tenants should be selected by the Corporation's officer in consultation with the Government Departments

concerned, and that each farmer should be supplied with 10 acres of cleared land, a pair of animals, plough and cultivator, and a water supply. Repayment to the Corporation of these advances should be made in the form of services, *i.e.*, each farmer should be required to plough, cultivate, weed and harvest one acre of the Corporation's 400 acres for each animal supplied to him.

The Corporation are in consultation with the Nigerian Government on these recommendations. If the scheme is ultimately adopted, it will mark an important development, not only because the extension of this system of mixed farming appears to constitute the only means whereby cotton exports from the Northern Provinces are likely to be materially increased, but also because the experiment, if successful, will constitute a distinct advance in agricultural practice in the country, and will doubtless point the way to similar developments in other parts of Africa.

In both the Northern and Southern Provinces, the demand for seed for the season 1933-34 was very keen, and in the North particularly a very considerable increase took place in the acreage planted. Unfortunately, however, weather conditions in the North were very unfavourable at planting time, and immediately afterwards. August was exceptionally wet, and water-logging checked the growth of all but the earliest planted cotton. Subsequently, in some parts at all events, the plants were scorched by the severe Harmattan. As a result, the yield per acre was very low. In the South, conditions were more favourable, and it is thought that the yield of Ishan cotton will prove to be up to the average. It is expected that the total Nigerian crop will be about the same as that of 1932-33.

Gold Coast.

Cotton-growing on quite a small scale is being carried on as before in Togoland and in the Northern Territories. The type of cotton grown in Togoland is the Improved Ishan cotton from Nigeria. Yields at the Kpeve Experiment Station were very satisfactory last season, the plots planted at the most favourable date yielding over 1,000 lbs. of seed cotton per acre. When grown on small plots cultivated by farmers the average yield was nearly 700 lbs. per acre. The quality of the cotton was reported on favourably by the ginnery in French Togoland. The scheme for establishing a ginnery in Togoland from funds raised from cotton farmers, which was put forward some years ago, has been in abeyance on account of local political or factional troubles, but it is intended to revive it when feasible.

In the Northern Territories, the Botanist has been successful in his efforts to breed a strain that will flower and fruit in the dry season of the year. Moreover, the selection hardly suffers at all from leaf curl, to which the original Allen cotton was susceptible. A point has been reached at which the yield of between 200 and 300 lbs. of seed cotton per acre, which can now be obtained, would have made cotton a paying proposition before the slump in prices, but at last season's prices the transport and other costs make this crop prohibitive. In view of a possibility of a revival in price, and having regard to the fact that cotton is used considerably for domestic purposes in the Northern Territories, work is being continued towards the further improvement of the selected strain, but the Department of Agriculture consider that further intensive botanical investigation is not justified at the moment. It is hoped, however, that the present standard will be maintained, and trials are being carried out by farmers in the district.

With regard to the season 1933-34 there is little to report. In Togoland farmers have adopted the Improved Ishan type, but heavy rains and high winds rendered the crop a complete failure on flat and low-lying land, while on the hillsides the yield and quality were poor. Very little cotton will be exported, the lint being used for domestic purposes and the seed for planting next season.

West Indies.

Reference has been made in previous Reports to the efforts that have been made to place the Sea Island cotton industry on a sounder basis. These included the proposal made at a Conference held in Barbados in 1932 to form an Association of growers with a view to the adoption of an agreed policy as to restriction of acreage, and to take other steps to improve the position that had arisen owing to the fall in prices and the accumulation of world stocks. The formation of the West Indian Sea Island Cotton Association at a Conference of delegates from the cotton-growing islands, held in Trinidad in November last, should strengthen the position of the industry. The Association will be financed by a voluntary levy on exported lint at a rate agreed upon by the delegates attending the Conference.

With a view to controlling production, a maximum acreage was agreed upon for the several islands, as well as a maximum amount of cotton to be exported from each island from the 1934 plantings. It was further agreed that no island should hold unsold, in the United Kingdom and Europe, a quantity of cotton from the 1934 plantings in excess of one-third of its average production for the 10-year period 1921-22 to 1930-31. The Conference also decided to set up an Advisory Committee in this country, to superintend and advise upon the work of the Association in the United Kingdom, which includes investigations into possible new

outlets for the consumption of Sea Island cotton, and the advertising of goods made from it. The Corporation is represented on this Committee by Mr. L. G. Killby.

At the Corporation's Cotton Station in St. Vincent, further selection work has been going on with a view to obtaining higher yielding strains of Superfine Sea Island, and it is of interest to record that on one estate the purified V.135 strain gave a yield of 405 lbs. of lint per acre over an area of 8 acres. The improved strain is thus clearly capable of giving high yields, and complaints of its performance in this respect may be due to the fact that cotton is possibly not receiving now so much care in cultivation as when better prices were obtainable.

Reference was made last year to the work that has been done at the Station on Moco cotton from Brazil, with a view to its possible introduction into the drier Grenadines. Unfortunately, when samples from this type grown in St. Vincent were subjected to spinning tests, they were reported as lacking strength. It is hoped, however, that this character may show improvement when the selections are grown in drier islands.

As the result of work in Carriacou, selections of Marie Galante cotton have been made in which both the yielding capacity and lint quality are considerably higher than in the commercial crop. The new selections are now being multiplied up.

Valuable work has also been carried out at the Station in connection with the hybridisation scheme planned by Dr. Harland with a view to improving the jassid-resistant U.4 cotton first selected at the Corporation's Station in South Africa. The material, produced by Dr. Harland in Trinidad, has been self-fertilised twice, records have been made of the

agricultural properties and lint characters of many different families, and the seed distributed for trial in most of the cotton-growing countries in which the Corporation are interested.

Mention must be made in this Report of the retirement last year of Professor H. A. Ballou, C.B.E., Professor of Entomology at the Imperial College of Tropical Agriculture, and Commissioner of Agriculture for the West Indies. Professor Ballou's service in the West Indies extended over thirty years, and his valuable experience has always been readily placed at the Corporation's disposal in the furtherance of their work.

The following notes on the last cotton season have been kindly supplied by the Agricultural Officers in the Islands through the courtesy of the Commissioner of Agriculture.

As a result of the recommendations made at the West Indian Sea Island Cotton Conference held in Barbados in 1932, the total area of the Sea Island cotton grown in the British West Indies was further reduced to 3,649 acres. Nearly two-thirds of this area were grown in Montserrat, under ideal cotton-growing conditions. In most of the other Islands, excessive rains proved rather unfavourable, and in some cases considerable additional damage was caused by pink bollworm and stainers. The leaf-eating caterpillar was not very troublesome.

The total amount of lint produced for the year was 631,181 lbs. Sea Island (1,577 bales of 400 lbs.), and 415,117 lbs. Marie Galante (1,037 bales of 400 lbs.).

St. Vincent.—In 1933 only 669 acres were reaped, whereas the areas reaped in 1931 and 1932 were 3,972 acres and 1,802 acres respectively. Pink bollworm and stainers

appeared in January, but the amount of damage inflicted was not more than usual. The heavy rainfall at the end of 1932 was rather unfavourable, and on one estate on the Windward coast wind damage was considerable. The average yield was 122 lbs. lint per acre.

Montserrat.—The area planted in cotton in 1933 was 2,182 acres. Of this area 104 acres were planted by estates, 933 acres by peasants on estate lands on the half-share system, and 1,145 acres by peasants on their own holdings. The season proved to be ideal, and in many districts record yields were obtained. The average return per acre was 219 lbs. of lint, and owing to the favourable weather conditions and the low incidence of pests and diseases, the lint was of very good quality.

Antigua.—The last three months of 1932 were very wet, and this, coupled with damage by pink bollworm, was responsible for a low yield of only 42 lbs. of lint per acre.

Nevis.—Planting was done in October, and as the rainfall in October, November and December amounted to nearly 32 inches, the weather was rather unfavourable to the crop. Pink bollworm appeared in January, but the pest was not so serious as in the previous year. Cotton stainers were, however, plentiful. The average yield was 100 lbs. lint per acre. The Government ginnery, which is for the use of peasants, ginned and sold 7,522 lbs. of lint out of the Island's production of 10,042 lbs., whereas the previous year it dealt with 8,696 lbs. out of a total of 23,737 lbs.

St. Kitts.—Conditions during the 1933 season were not favourable to cotton-growing. The weather was very dry in March and there was great difficulty in getting the crop properly established. The late planted cotton suffered from the effects of a storm which passed to the north of the Island

in July. The leaf worm (*Alabama*) did little or no damage, but pink bollworm was very prevalent on the late planted fields.

Anguilla.—Although pink bollworm was prevalent the quality of the lint was better than last year. There were no attacks of cotton leaf worm.

COTTON.

PRODUCTION AND EXPORT FIGURES FOR COTTON IN 1932–33.

Island.	Acres.	Production.			Export.		Year.
		Lbs.	Bales of 400 lbs.	Lbs. per acre.	Lbs.	Bales of 400 lbs.	
				SEA ISLAND.			
St. Vincent...	669	81,852	204	122	160,792	402	1932–33
Barbados ...	234	14,593	36	62	67,948	170	1932–33
Montserrat ...	2,182	477,097*	1,193	219	599,621†	1,499	1933
Antigua ...	200	8,400‡	21	42	8,400	21	1932–33
Nevis ...	100	10,042	25	100	5,722	14	1932–33
St. Kitts ...	130	20,430	51	157	56,910	142	1933
Anguilla ...	134	18,767	47	140	24,098	60	1932–33
				MARIE GALANTE.			
Grenada ...	4,000	339,000	848	85	339,000	848	1932–33
St. Vincent...	800	76,117	190	95	78,508	196	1932–33

*Includes 29,407 lbs. stains. †Includes 48,872 lbs. stains.
‡ „ 600 „ „

ESTIMATED ACREAGE AND CROP FOR 1934 AND 1933–34.

Island.	Acres.	Estimated Production lbs.	Year.
		SEA ISLAND.	
St. Vincent ...	1,200	132,000	1933–34
Barbados ...	62	—	1933–34
Montserrat ...	—	Not yet available.	1934
Antigua... ...	60–70	9,000	1933–34
Nevis	650	72,000	1933–34
St. Kitts ...	200	40,000	1934
Anguilla ...	280	37,534	1933–34
		MARIE GALANTE.	
Grenada ...	4,000	330,000	1933–34
St. Vincent ...	700	63,000	1933–34

Cyprus.

Last year reference was made in the Report to the fact that the Agricultural Department were carrying out various experiments, including trials with imported varieties of cotton, with a view to deciding the best types for Cyprus conditions. Their experiments reached a stage last season at which they were in a position to send samples of the 1932 crop for spinning tests. The samples sent included an indigenous variety, a strain known as Titsiros, and imported varieties—Mesowhite, obtained originally from Iraq, and U.4 obtained from the Corporation's Plant Breeding Station at Barberton, South Africa. The tests showed that the two latter were greatly superior in spinning quality to the local varieties; whereas the indigenous variety was suitable for counts from 10s. to 12s. and Titsiros for counts 16s. to 18s., U.4 proved suitable for 54s. to 56s. and Mesowhite for 58s. to 60s. The Agricultural Department, in acknowledging these reports, stated that the results would be of considerable value to them.

The actual area planted in Cyprus each year depends largely on the amount of irrigation water available for cotton in competition with other crops that are grown in larger quantities. In 1933 both irrigated and non-irrigated cotton suffered through the depleted irrigation water supplies and the lack of sufficient rain. The area was again reduced, and the production is the lowest on record since the British Occupation.

The following table shows the area and production for the last five years:—

Year.	Area Planted. Acres.	lbs. Seed Cotton.
1929	11,188	4,693,472
1930	21,333	6,290,592
1931	11,301	3,819,536
1932	6,299	1,492,960
1933	4,795	1,217,664

The prospects for 1934 are more hopeful: good rains have fallen in all areas, and it is anticipated that the normal acreage will be planted.

Fiji.

Owing to the low prices obtainable for Sea Island cotton, and the large stocks then held in this country, the Fiji Government decided to suspend cotton growing on a commercial scale for 1933, to plant only a sufficient area to maintain a supply of Sea Island seed, and to concentrate on the multiplication of the Kidney x Sea Island hybrids raised by Mr. Anson, which it was hoped might have a staple comparable with Sakel, and thus command a wider market than Fiji Sea Island.

It was reported last year that one or two bales of this hybrid were being sent home for testing on a small commercial scale. The results showed that improvements would need to be made in this cotton before it could hope to find a ready market. It lacked strength and was rather high in colour. The report was much appreciated, however, as it emphasised the weak points of the variety, and Mr. Anson is sending further samples for test this year, which he hopes will prove more satisfactory. The yields obtained from this strain grown at the Fijian Agricultural centres reached over 1,200 lbs. of seed cotton per acre in those places which did not suffer damage by flood in April.

The cost of transport from Fiji is at present so heavy that it would seem doubtful if cotton can be grown there profitably unless the world price rises considerably. At present the growers, both Indian and Fijian, are unwilling to grow the crop at a lower price; cane, which yields a return to the grower of £6 to £8 an acre, is taken as a basis of

comparison, and crops yielding appreciably less do not find favour. Nevertheless, those natives and Indians who are not absorbed in the sugar industry are in need of a cash crop, and it is believed that cotton is likely to become the most profitable alternative.

For the current season the Government have restricted the cotton area to 700 acres, half under the new hybrid and half under Sea Island. Early and continuous rains in January encouraged Indian ryots to plant with rice land originally prepared for cotton, and owing to generally unfavourable weather conditions, only 350 acres were planted by the end of January; half of this area is under the backcross hybrid, confined to the Sigatoka district, and half is under Sea Island cotton, confined to the Lautoka and Ba districts. It was anticipated that if the weather improved, further plantings would be made.

Mr. Anson is of opinion that Sea Island cotton is uneconomic at present prices, and that the growing of it will have to be abandoned, in which case the future development of the cotton industry will depend entirely upon the success of the new backcrosses.

Research.

Research Station, Trinidad.—The Director paid a visit of inspection to the Station in February and was able to give a satisfactory report of the work in progress.

Last year Dr. Harland was given study leave in order that he might accept the invitation given him by the President of the Lenin Academy of Agricultural Sciences to see something of the genetics work that is being carried out in Russia, including the cotton-growing districts in the Crimea, Transcaucasia and Turkestan. Dr. Harland's tour lasted for

three months, and on his return he gave the Corporation an extremely interesting account of the considerable advances that the Russian scientists are making along many important lines in connection with plant breeding and genetics.

Genetics Department.—Dr. Harland has kindly furnished the following note on the work of his Department :—

During the past year four papers from the Department of Genetics have been accepted for publication in the Journal of Genetics. These are as follows :—(1) The Genetics of Cotton. Part IX. Further Experiments on the Inheritance of the Crinkled Dwarf Mutant of *G. barbadense* L. in Interspecific Crosses and their Bearing on the Fisher Theory of Dominance.—S. C. Harland. (2) The Genetics of Cotton. Part X. The Inheritance of Leaf Shape in Asiatic *Gossypiums*.—J. B. Hutchinson. (3) Cytological Studies in Cotton. II. Two Interspecific Hybrids between Asiatic and New World Cottons.—A. Skovsted. (4) The Genetics of Cotton. Part XI. Further Experiments on the Inheritance of Chlorophyll Deficiency in New World Cottons.—S. C. Harland.

Mr. J. B. Hutchinson has left the Department on his transfer to Indore, and his place has been filled by Mr. R. A. Silow of the Welsh Plant Breeding Station, Aberystwyth.

Investigations are being continued along the following lines :—

The cytology and genetics of interspecific crosses in Gossypium. The possibility of transferring characters from wild to cultivated cottons is being gone into in great detail, as mentioned in previous reports. It is possible to obtain relative fertility in the following crosses : (*a*) New World cotton x cultivated Asiatic. (*b*) New World cotton x *Gossypium lanceœforme* (=*Thurberia thespesioides*). (*c*) New World cotton x *Gossypium* (*erioxylum*) *aridum*.

It is intended to attempt to transfer certain standard genes from the wild to the cultivated cotton types by repeated backcrossing, and at the same time to attempt to transfer such important characters as immunity to angular spot to the cultivated cotton. By the method of repeated backcrossing we have succeeded in transferring the gene for red plant body from Asiatic to U.4 Upland, and consequently in obtaining a perfectly fertile Upland variety with an Asiatic gene.

The linkage relation of the Asiatic red gene to the multiple allelomorph Spot-Red series of New World cottons has been studied, and the Asiatic red gene has been found to be a member of this allelomorphic series. For the first time, therefore, homology of genes in the Asiatic and New World cottons has been demonstrated.

Other questions under investigation are as follows:— (*a*) The use of mutants such as Crinkled Dwarf to assess taxonomic affinities of species in Gossypium. (*b*) The distribution of duplicate genes in Gossypium. (*c*) The inheritance of such quantitative characters as lint length. (*d*) Linkage relations in the cotton plant.

Much light has been thrown on Fisher's theory of Dominance by studies in this Department and investigations of dominance have been continued.

Some new synthetic types have been bred out in the course of the pure genetic experiments, and among these is a new Sea Island type exhibiting extreme hairiness in all parts of the plant body. It is now possible to transfer the hairiness complex to any desired type.

An additional greenhouse has been sanctioned and this will enable the work to be speeded up considerably, since it is possible to obtain about five generations in two years.

Physiological Department.—During the year Dr. Mason spent some months in Germany studying the methods used by plant physiologists in that country. In Trinidad much time was spent on the preparation of papers for publication. The following papers prepared during the year are being published in the Annals of Botany, and have either already been, or will shortly be, issued by the Corporation as Memoirs of the Research Station:—(1) The Polar Distribution of Sugar in the Foliage Leaf. (2) An Ontogenetic Study of Concentration and Vertical Gradients. (3) Concerning the Independence of Solute Movement in the Phloem. (4) Concerning Storage in the Bark. (5) Preliminary Observations on the Transport of Sulphur, Magnesium and Chlorine.

Dr. Mason has been good enough to supply the following account of the work in progress:—

While examining the concentrations of the various mineral elements in the sap of the cotton plant, we found to our surprise that a considerable portion of the water in the plant does not dissolve sugars and salts in the same way that water normally does. This water has been termed "bound-water." A simple method of estimating the amount of bound-water in the plant has been developed. As bound-water is probably a factor of great importance in drought resistance the method may prove of value in the selection of drought-resisting strains.

In continuation of our work on Transport, much attention has been devoted to the oxygen supply of the conducting tracts. This work is still in progress, but there are grounds for the belief that oxygenation depends on oxygen-carrying bodies, possibly akin to the hæmoglobin of the blood, and that these bodies are mobile. The oxygenation of lint and seed may also depend on oxygen carriers and not on free oxygen.

Some work on boll shedding suggests that substances comparable to the hormones of animals may be a factor. Under normal conditions of food supply the young seed liberates these substances, which move back and regulate the growth of the pedicel. Under conditions of starvation or injury, or of abnormal metabolism, the manufacture of these substances ceases and the growth of the pedicel is checked and abscission ensues.

Other lines of work include a study of the distribution of solutes in cytoplasm and vacuole, the path of transport of dyes in the phloem, and the mechanism of food export from the corolla prior to its abscission.

Experiment Stations.—The annual volume of Reports received from Experiment Stations was issued, as usual, in February. In accordance with the practice now followed, full reports are furnished each year by four Stations, and summaries from the remainder. The four full reports this year came from South Africa, Swaziland, Queensland and St. Vincent.

The production of improved cottons has naturally been the chief work at nearly all Stations. In South Africa, re-selection of the original U.4 cotton has produced strains showing an increased yield of 10-15 per cent.; these have been tested under drought conditions of the last few seasons, but it is desired to test them in a rainy season also before deciding which of them is most suitable for general distribution. A number of crosses in which U.4 is one of the parents have been made by Dr. Harland in Trinidad, with a view to improving the type in certain respects, and the seed has been distributed for trial in a number of countries in Africa.

The St. Vincent report contains an interesting description of the work of purifying the Superfine Sea Island, which is now the only type of cotton grown in the Island.

The study of methods of cultivation has been carried on at most Stations, notably in Queensland and South Africa. One problem of importance is the effect of a bare fallow on the subsequent crop of cotton. Experiments continue to be conducted also on various rotation crops, and their effect on the cotton crop.

Investigation of insect pests is naturally a most important line of work also. In South Africa and Rhodesia, now that the plant breeders have succeeded in producing a type that is resistant to the jassid pest, the discovery of some means of combating the bollworm and stainer is the next most urgent problem. In the section of this Report dealing with South Africa, reference has been made to the extension of this work, and to its co-ordination between several of the Corporation's experiment stations, with a view to making the results obtained comparable, and to enabling the behaviour of the pests to be recorded under different conditions.

Home Universities and Institutions.—Cambridge University.—Up to the outbreak of War, agriculture at home and in many tropical areas was so comfortably placed that it could offer the possibility of a career to young men of common sense and energy, but without special knowledge. To-day, common sense and energy must be backed by sound training not only among those seeking specialist appointments, for example, in mycology or soil science, but also in those who are to farm themselves or to manage or guide the farming of others. The range of sciences and the practical knowledge which training for various kinds of agricultural work should include are now matters of general agreement. It has come

to be realised, also, that on the land, no less than in the factory, labour, marketing, financial policy, the interaction of one product or one country upon another, and many other problems of this kind, lie at the root of success. But over and above knowledge of this kind a student, if he is to become a successful farmer, planter or tropical agricultural officer, must possess a " business sense," in other words an instinct for quickly perceiving opportunities and possibilities, a faculty of the imagination rather than of reasoning. While no course of instruction, however " practical," can create this sense in a man born without it, sound training can develop and encourage it where it already exists, and it may be of interest to describe here one step that is being taken in this direction at Cambridge with a view to giving due, but not excessive, prominence to this aspect of the training of those who intend to adopt an agricultural career.

During the past four years in the School of Agriculture at Cambridge, there has been maintained for graduate students—including all those destined for cotton-growing countries—a system of excursions known unofficially as the " Beagles." A cross-country route of some five to six miles is selected by members of the Staff. These, representing practical agriculture, soil science, botany, and other branches, carefully reconnoitre the route in advance, selecting it to illustrate points of cardinal importance and seasonal interest. The " Beagles," proceeding to the starting-point by bus or bicycle, according to the distance, go over the route, setting out immediately after an early lunch and finishing when darkness comes on, with tea at the inn from which the expedition started. The main purpose is to encourage students :

(i) To decide by observation, inspection of soils, examining the crops, and in any other appropriate way,

what are the inherent agricultural characters of the area, *e.g.*, soils, drainage, etc., and also its business advantages, *e.g.*, accessibility of roads, water supply, etc.

(ii) To form an opinion of the use to which these inherent possibilities are in fact being put by the occupiers of the land.

(iii) For one or more of the farms of the area, to work out the general policy of crops and stock, to determine the sources of income and expenditure, and the general success achieved.

(iv) To suggest changes or developments, remembering the economic circumstances concerned.

(v) To call attention by questions to any matter of interest, *e.g.*, a fungus, an implement or a cultivation, which they do not fully understand.

(vi) To work out a number of specific problems, *e.g.*, the treatment required for a field in bad condition.

Men in training for specialist appointments, *e.g.*, cotton breeders, go out also with the "Beagles." Their special knowledge often contributes points of interest to the others. Further, they themselves are brought into close contact, as every specialist should frequently be, with the practical and business aspects of the industry to the progress of which it is their duty to apply their scientific knowledge.

Sometimes a short lecture on the area to be traversed is given on the previous evening, particularly if the type of farming or the economic circumstances are unusual.

During the past three years the Farm Economics Branch of the School of Agriculture has been making a Farm Management Survey of the Eastern Counties. From this are

now known the average values, in the various component areas, of capital per acre, of grass out-turn per acre, and so on, while tests of efficiency such as " gross output per £100 of manual labour," " livestock output per £100 foods " and " gross output per £100 farm capital " can also be applied. A study of farms by " beagling " over them in relation to economic data of this kind is found to promote in men reading agriculture a lively sense of the importance of treating agriculture as a business—as " the production of crops and stock for profit."

Manchester University. — The vacant Research Assistantship in the Mycology Department was filled in October, 1933, and the work has been carried on during the year 1933-34, both on physiological and cytological lines. The first part of the investigation of the physiology of the mould *Aspergillus niger,* isolated from cotton bolls, has been completed, and is awaiting publication. A full cytological study of *Neurospora tetrasperma* has been completed and published. A cytological investigation of *Melanospora Zamiae,* mentioned in the previous report as having been isolated from diseased cotton, is nearing completion; some interesting results have been obtained confirming those previously established by work on *Neurospora.*

In the Entomology Department, further experiments have been performed on oviposition and on the effect of humidity on the hatching of the eggs of *Dysdercus howardi,* one of the cotton stainers. A paper containing some of the results of these experiments is being prepared and should be ready for publication shortly.

Experiments on the effects of sudden variations in temperature on the life cycle of *Thrips tabaci* have also been continued. A paper " On the Biology of *Anagrus atomus*

Hal., an egg parasite of the leaf-hopper *Erythroneura pallidifrons*. Edwards," has been accepted for publication by *Parasitology*, and contains results of work done during the session 1931-32.

London University, King's College.—In recent years research into the structure of the cells of plants has thrown considerable light on the mechanism of evolution. In every cell are contained small thread-like bodies known as chromosomes. Each species has a constant number in its cells, which are transmitted by splitting in every cell division, and it has been found that the numbers, which vary from species to species, are of fundamental importance in connection with the origin and genetics of many cultivated and wild plants. Substantial progress has been made in determining how new numbers arise and hence how new species appear.

By investigating the chromosomes in various genera of plants (*Malvaceae*) related to cotton, it will be found in which genera the fundamental number occurs, and which genera have their chromosomes in multiple series, like the cottons and the genus *Lavatera*. It may be expected that this will throw further light on the evolution and genetics of cotton.

Seed of over 50 species of Malvaceae has been obtained from various parts of the world, and they will be grown in Regent's Park this summer for a study of their chromosomes. It seems likely that a broad cytological attack on the family will yield information of fundamental importance in the interpretation of the results obtained in crossing the species of cotton.

Imperial College of Science and Technology.—The work on the physiological effect of manures has been continued, and particularly on the effect of manurial balance and of the

physiological effects of nitrogen, phosphorus and potassium, all subjects of importance in the cultivation of cotton. The work on the behaviour of the fungus (*Nematospora gossypii*) which causes internal boll disease and exhibits marked peculiarities in growth since it will not develop on a synthetic medium, has been completed, and the results published (*Biochemical Journal*, 27, 1859-1868, 1933).

Consignments of cotton seed have been sent from time to time to the Biological Field Station for sterilisation, and a number of these have been treated. Investigations of the scientific principles underlying fumigation against insect attack have been continued in the Entomology Department of the College and at the Field Station. These have led to a fuller understanding of the action of fumigants and of the methods of fumigation to be applied.

Rothamsted Experimental Station.—The experiments on soil cultivation done by Dr. Keen and the staff of the Physics Department have given suggestive results. In the 1932 season a test was made of the effects of intensive surface cultivation on the yield of sugar beet and kale on both light and heavy land. In all cases, cultivation in excess of the minimum needed to keep down weeds and break any surface crust produced a decrease in yield. The experiments are being repeated to see how far the effects are connected with the type of season; they deserve repetition on cotton soils, as there is no reason to suppose that the effects are restricted to these two crops.

Considerable progress has been made in the development of rapid laboratory tests specifying the physical and physico-chemical properties of soils, and the relationships of these measurements to the inherent fertility of the soils, with special reference to tropical and sub-tropical types. It is not yet

possible to say which soil properties are in general most closely related to inherent soil fertility, but when the samples come from a relatively restricted area, and embrace a limited number of soil types, reasonably satisfactory relationships have been obtained, which could be used to predict the probable fertility of other areas within the region in question.

Work has been continued in the field plots and in the Chemistry Department under Dr. Crowther on the chemical aspects of crop rotation. In a field experiment studied in detail throughout 1932 and 1933, wheat after fallow yielded twice as heavily as wheat after ryegrass and wheat after clover gave intermediate values. The soil analyses during the early growth of the wheat showed that all treatments left but small and almost equal amounts of nitrate in the soil, though there had been very wide differences in nitrate content during the preceding autumn. It would appear that the subsoil stored up reserves of nitrate which were not detected in the ordinary sampling of the surface soils. It is possible that similar effects may occur in cotton soils with retentive subsoils. Fallowing may then be regarded as a means of storing both moisture and available plant food.

A full re-examination of the Sudan Gezira cotton yields and rainfall data fully confirmed the important adverse effect of early rainfall.

The Statistical Department under Mr. Yates has continued to supply advice to overseas experimenters upon the interpretation of field trials, and on the problems which arise in the design of satisfactory experiments, both in the agronomic and plant-breeding sphere (applied genetics).

Mr. J. B. Hutchinson, late Assistant Geneticist at the Corporation's Research Station, Trinidad, now at the

Institute of Plant Industry, Indore, Central India, spent a period with the Department studying genetical statistics.

Mr. J. Marshall, who has been appointed to carry out work in the insect pest control department of the Corporation's Station at Barberton, has been spending a year of intensive study in the Entomological Department at Rothamsted under Dr. Williams.

Conference of Workers on Cotton-Growing Problems.

The Corporation have decided to hold a second Conference, similar to that which was held in 1930, which workers on cotton-growing problems from various countries have been invited to attend, as well as those engaged on work in this country involving cognate problems. The Conference will be held at the offices of the Corporation on July 18th and 19th, and it is hoped that it may be possible for several members of the Research Station Committtee to be present, thus enabling members of the staff who are home on leave to meet those who are good enough to act as the Corporation's advisers on scientific problems.

At the time when this Report was written, advice had been received that 15 cotton-growing countries would be represented. In addition, representatives will attend from Cambridge and Manchester Universities, the Imperial College of Science and Technology, Rothamsted Experimental Station, the British Cotton Industry Research Association and the Imperial College of Tropical Agriculture. The procedure will be generally similar to that of four years ago. Those who propose to submit papers for discussion at the Conference have been asked to send their papers in advance, so that they may be circulated with the agenda. No papers will actually be read at the Conference

itself, in order that the whole time may be available for the interchange of views, but the author of each paper will be invited to open the discussion on it.

Spinning Tests.

The Departments of Agriculture and the Corporation's staff continue to take advantage of the facilities provided for obtaining brokers' reports and spinning tests on small samples of cotton. The number of such samples received was slightly smaller than last year, chiefly owing to a reduction in the large number sent from the Sudan.

Four samples were received from Cyprus, for the first time since 1927. The types included local cottons, Meso-white, and U.4, and the results showed that the two latter were decidedly superior in spinning quality.

Some interesting samples were submitted from St. Vincent, arising from the work that is being done with a view to improving the Marie Galante cotton in the Grenadines, either by selection from the existing type or by replacing it by strains of Moco cotton from Brazil. Both types were tested by the Fine Cotton Spinners' Association, and the results showed that at present the improved Marie Galante, grown in Carriacou, is decidedly the better.

Reference has been made in previous reports to Mr. Anson's work in Fiji, in attempting to produce a hybrid cotton which would be comparable in staple to Egyptian. If this can be achieved, the intention is to grow it commercially in substitution for Sea Island, for which there is at present so limited a market. By the courtesy of Messrs. Knowles Ltd., Bolton, two bales were subjected to a commercial test

last year, and their hair characters were also measured at the Shirley Institute. Unfortunately, the results showed that the hybrid cotton was neppy and lacked strength; further selection work has since been carried out, and samples are being sent for test again this year.

Samples have again been received from Tanganyika, comprising "locality" tests on the local variety, and comparative tests on S.G. 29 (from Uganda), U.4, and selections from U.4. Hitherto U.4 has proved inferior in spinning quality to the local variety in Tanganyika, but in those parts of the country in which jassids are a serious pest, a jassid-resistant strain would seem to be essential, and hence it is desirable to obtain, if possible, a strain of U.4 having improved spinning qualities, but retaining all its valuable agricultural properties. Of the samples of the local variety, the most satisfactory were those grown in the Rufiji Valley, under conditions of flood irrigation. The cotton is sown as the flood water recedes, and an ample supply of water is always available at the roots: thus cotton grown under such conditions is more or less independent of rainfall.

Among the samples sent from Northern Nigeria were two in connection with an experiment on the ginning of small samples. At the Corporation's seed farm an attempt was made to adapt a commercial saw-gin for the treatment of small samples of seed-cotton, produced by the Government botanists, which have usually been ginned on a hand-gin. Two samples of the same seed-cotton were ginned—one in the ordinary way on a full-sized gin, the other on the same gin but with a saw removed and the seed roll divided by a wooden partition. Both the broker and the Spinning Tests Sub-Committee gave preference to the sample ginned on the full-sized gin, but no difference between the two samples was detected either in hair characters or in yarn strength. The

sample ginned on the partitioned gin gave slightly higher waste losses in the scutcher and card, but as waste loss figures for small samples are in any case of low significance, there appears—from the results of this test—to be no reason why a partitioned gin should not be used for comparative spinning tests on small samples.

Of the remaining samples from Nigeria, S.G. 29 (introduced from Uganda), gave the best all-round results, closely followed by samples of Strains L and D (selections from the local Allen variety), and one of S.G. 27—another Uganda variety. For several seasons strain L has given consistently good spinning test results, except when grown on poor land.

In the usual series of tests on samples of American-type cotton from the Sudan, three samples were superior in strength to the established variety—Pump Scheme Strain—but only one gave a yarn that was its equal in appearance.

For many years now the Egyptian-type cottons from the Sudan have been tested in the Experimental Department of the Fine Cotton Spinners' Association, but the Association have decided that this practice should be discontinued now that the Shirley Institute is equipped for testing cottons of that staple. It is desirable that all such tests should be concentrated at one place, and in order that the change-over may be made without any break, and to enable comparisons to be made, it has been decided that this year the spinning tests will be carried out on duplicate samples, one set being spun at the Shirley Institute and the other by the Fine Cotton Spinners' Experimental Department. The growers will then be able to compare the reports on the tests on the same samples carried out at two places. Furthermore, the Fine Cotton Spinners' Association have kindly supplied the Shirley

Institute with copies of their spinning tests reports of previous years, so that the course of the work may be traced and followed up.

The Corporation take this opportunity of conveying to the Directors of the Fine Cotton Spinners' Association their warm thanks for the very great help that they have given to their work by allowing these spinning tests on long staple cottons to be carried out for so many years in their Experimental Department.

In the more recent spinning test reports from the Shirley Institute, figures have been given for the " highest suitable warp counts " with a view to indicating the relative spinning values of the samples in terms of the highest warp counts for which they are severally suitable. The value of the " highest suitable warp count " for any one sample is calculated from the lea count-strength products of the two or more yarns of different count spun from that sample, by assuming a linear relationship between lea count-strength product and count, and noting the intersection of the line so obtained with a horizontal line representing the strength standards decided upon, viz., lea count-strength products of 2,000 for carded yarns spun with a twist factor of 3.75, and 2,250 for combed yarns spun with a twist factor of 3.5. These values have been chosen because the majority of the cottons subjected to spinning tests at the Shirley Institute fall either in the long-staple American class for which the carded standard is suitable, or in the Sakel class for which the combed standard is suitable. The utility of the " highest suitable warp count " lies in its providing one single index of spinning quality based upon the results of several spinnings. It should be noted that this index is to be regarded only as an approximate one, which does not entirely replace the lea

count-strength products of the individual yarns; but it is often convenient to be able to express the spinning quality of a cotton in one figure, and the " highest suitable warp count " will therefore be included in all future reports.

Mechanical Transport.

Following the practice of the last three years a summary is given of the progress made by the Oversea Mechanical Transport Directing Committee, of which Sir James Currie is Chairman.

The first motor transport unit, to handle a useful load of 15 tons, completed its tests in the Gold Coast in October, 1933, after covering some 8,000 miles, chiefly over the 240 miles between Kumasi in Ashanti and Tamale in the Northern Territories. Most of the mileage was covered over lightly built roads having a surface of laterite gravel with occasional stretches of cotton soil embankment, and it proved possible to work the unit during the rains, at times when the Government Transport Department could not use their 2-ton lorries on account of the damage they would have caused to the roads.

Owing to the low prices obtainable for agricultural produce, it was not possible to secure full 15-ton loads for the unit regularly in both directions, and the average load carried over the 8,000 miles worked out at 8.6 tons. In spite of this, and after making full provision for interest, depreciation, and all other appropriate charges, the cost of transport by this unit amounted to $5\frac{1}{2}$d. per ton-mile. Had full loads been available for each journey, or had there been no delays while freight was collected, the cost per ton-mile would have been considerably lower. Further, the cost of

petrol at Kumasi averaged 2s. 3d. a gallon, whereas the cost of gas oil was 8d. a gallon. Had this unit been fitted with a heavy oil engine, the cost per ton-mile would have been reduced by about 1d.

The Gold Coast Government decided to purchase the tractor and its two trailers on the completion of the Committee's tests.

The second 15-ton unit, built on the same general lines as the first, but fitted with a heavy oil engine, completed its tests in England in January, and was shipped to Australia on February 27th, 1934. After trials in South Australia to demonstrate its capabilities for wheat harvest transport, the unit is being driven to Alice Springs in North Australia. Then it will be employed in general transport between Alice Springs and Birdum, which lies approximatey 600 miles to the north.

Trials of various motor vehicles likely to be useful for work oversea have been continued during the year. Confidential reports on these trials are circulated for the information of officers likely to be interested, and any shortcomings revealed by the tests are discussed with the manufacturers.

The publication of the Oversea Mechanical Transport Bulletin has been continued during the year.

EMPIRE COTTON GROWING CORPORATION.

EMPIRE COTTON CROPS FOR THE YEARS 1923-33, EXCLUDING INDIA.

IN BALES OF 400 lbs.

The seasons are given as covering two years (*e.g.*, 1926–1927) because in the majority of the countries named planting takes place in one calendar year and picking in the next. In a few of these countries, however (*e.g.*, Tanganyika, Iraq, Cyprus, Malta and some of the West Indian Islands), the crop is harvested in the same year as that in which it is planted. In such cases the figures should be read as relating to the crop grown and harvested in the *latter* of the two years at the head of the column.

Country.	1922–23.	1923–24.	1924–25.	1925–26.	1926–27.	1927–28.	1928–29.	1929–30.	1930–31.	1931–32.	1932–33.	
(1) Anglo-Egyptian Sudan	28,306	47,652	44,912	121,131	148,118	126,115	161,536	157,769	120,310	234,964	137,384	(1)
(2) Uganda	88,046	128,604	196,038	180,859	131,728	138,486	204,057	129,969	191,305	203,265	294,828	(2)
(3) Kenya	1,200	1,653	2,250	2,046	1,232	1,241	1,984	1,518	800	1,735	3,037	(3)
(4) Tanganyika	11,434	18,793	21,724	24,280	15,966	32,954	27,785	23,135	11,351	18,039	28,490	(4)
(5) Nyasaland	4,036	6,873	7,718	4,976	2,792	4,470	6,095	9,331	4,205	5,067	5,942	(5)
(6) Northern Rhodesia ..	102	500	379	506	32	17	—	—	—	—	—	(6)
(7) Southern Rhodesia ..	—	1,650	4,907	6,803	639	90	280	1,481	1,974	579	355	(7)
(8) Union of South Africa and Swaziland ..	6,523	8,730	16,936	20,381	10,242	11,013	9,774	16,213	8,123	2,801	1,860	(8)
(9) Nigeria	16,811	25,694	39,137	47,909	27,464	20,930	32,126	43,925	18,850	6,268	24,366	(9)
(10) Gold Coast	15	93	1,132	1,218	285	264	296	200	297	263	68	(10)
(11) Cyprus	2,233	3,397	3,320	4,614	2,110	2,146	3,520	4,718	2,865	1,119	913	(11)
(12) Malta	118	573	782	507	342	541	379	293	201	41	34	(12)
(13) Iraq	1,100	2,400	2,540	3,500	1,800	5,200	4,700	3,300	960	409	—	(13)
(14) Ceylon	49	324	121	261	186	202	380	248	95	52	—	(14)
(15) Queensland	9,344	11,850	14,318	7,179	5,880	10,266	6,296	13,999	12,228	4,975	13,903	(15)
(16) Fiji	85	157	123	824	356	114	271	398	266	90	8	(16)
(17) West Indies	5,295	4,309	4,186	5,941	6,076	4,088	5,312	5,672	5,106	2,524	2,614	(17)
	174,697	263,252	360,523	432,935	355,248	358,137	464,791	412,169	378,936	482,191	513,802	
		Percentage Increase 50·6.	*Percentage Increase* 36·9.	*Percentage Increase* 20·0.	*Percentage Decrease* 17·9.	*Percentage Increase* 0·8.	*Percentage Increase* 29·7.	*Percentage Decrease* 11·3.	*Percentage Decrease* 8·0.	*Percentage Increase* 27·2.	*Percentage Increase* 6·5.	

EMPIRE COTTON GROWING CORPORATION

MILLBANK HOUSE 2, WOOD STREET, MILLBANK, LONDON, S.W.1.

LIST OF PUBLICATIONS ISSUED TO DATE. THOSE STILL IN PRINT CAN BE OBTAINED DIRECT FROM THE CORPORATION AT THE ABOVE ADDRESS.

"Cotton Growing within the British Empire and The World's Capacity for Consuming Cotton Goods." J. W. McConnel. 1921. Price **2s.**, post free.

"Cotton Growing in Nigeria." Sir Hector Duff. Price **2s.**, post free.

"The Extension of Cotton Cultivation in Tanganyika Territory." Major Hastings Horne. 1922. Price **2s.**, post free.

* "Cotton Cultivation in Nyasaland." H. C. Sampson. 1922.

"Cotton Growing in South Africa." G. F. Keatinge. 1923. Price **2s.**, post free.

* "Cotton Growing within the British Empire." L. G. Killby. 1924.

"A Cotton Research Station for the British Empire." Professor J. B. Farmer and Mr. L. G. Killby. 1925. Price **2s.**, post free.

"Report on the Cotton-Growing Industry in Uganda, Kenya, and the Mwanza District of Tanganyika." Col. C. N. French. 1925. Price **1s. 3d.**, post free.

"Reports received from Experiment Stations for the Seasons 1923, 1924 and (South Africa only), 1925." Price **2s.**, post free.

"Memorandum by the Mechanical Transport Sub-Committee." Mr. G. H. Baillie, Mr. R. H. Brackenbury, Col. C. N. French. 1925. Price **2s.**, post free.

"Report on the Cotton-Growing Industry of Nigeria, 1926." Col. C. N. French. 1926. Price **2s.**, post free.

* Out of print.

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LIST OF PUBLICATIONS—*continued.*

" The Principles and Practice of Yield Trials." F. L. Engledow and G. Udny Yule. 1926. Price **2s.**, post free.

" Reports received from Experiment Stations, 1925–26." Price **2s. 6d.**, post free.

" Report on Suitable Rotation Crops for Cotton." H. C. Sampson. 1927. Price **1s.**, post free.

" Cotton Growing in Southern Africa and the Rhodesias." Report on a Tour undertaken by Sir James Currie, Mr. J. S. Addison, and Mr. H. C. Jefferys. 1927. Price **2s.**, post free.

" Reports received from Experiment Stations, 1926–27." Price **2s. 6d.**, post free.

* " Reports from Turkestan Plant Breeding Station, Tashkent." 1928.

" Review of the Situation in the Principal Cotton-Growing Territories of the Empire, and a Summary of the Main Activities of the Corporation since their Formation." 1928. Price **6d.**, postage extra.

" Report on Cotton Breeding and Seed Supply in Nigeria, 1928." F. L. Engledow and C. N. French. Price **2s.**, post free.

* " Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 1. Studies on the Transport of Carbohydrates in the Cotton Plant. Parts I and II. T. G. Mason and E. J. Maskell. 1928.

* " Reports received from Experiment Stations, 1927–28."

" Memoirs of the Cotton Research Station, Trinidad." Series A, Genetics. No. 1. The Inheritance of (i) Petal Spot, (ii) Pollen Colour. (iii) Corolla Colour. S. C. Harland. 1929. Price **2s. 6d.**, post free.

" Reports received from Experiment Stations, 1928-29." Price **2s. 6d.**, post free.

" Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 2. Studies on the Transport of Nitrogenous Substances in the Cotton Plant. Parts I, II and III. E. J. Maskell and T. G. Mason. 1930. Price **2s. 6d.**, post free.

" Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 3. Studies on the Transport of Nitrogenous Substances in the Cotton Plant. Parts IV and V. E. J. Maskell and T. G. Mason. 1930. Price **2s. 6d.**, post free.

* Out of print.

List of Publications—*continued.*

" Conference of Workers on Cotton Growing Problems, held August, 1930." Papers and Discussions. Price **2s. 6d.,** post free.

*" Reports received from Experiment Stations, 1929–30."

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics No. 2. Studies on the Inheritance of Corolla Colour and Petal Size in Asiatic Cottons. J. B. Hutchinson. 1931. Price **2s. 6d.,** post free.

" Reports received from Experiment Stations, 1930–31." Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics. No. 3. (*a*) Reversal of Dominance in the Interspecific Cross *G. barbadense* Linn. × *G. hirsutum* Linn. and its Bearing on Fisher's Theory of Dominance. (*b*) The Inheritance of Chlorophyll Deficiency in New World Cottons. By S. C. Harland. (*c*) " Crumpled." A New Dominant in Asiatic Cottons produced by Complementary Factors. J. B. Hutchinson. 1932. Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics. No. 4. The Inheritance of Anthocyanin Pigmentation in Asiatic Cottons. J. B. Hutchinson. 1933. Price **2s. 6d.,** post free.

" Reports received from Experiment Stations, 1931–32. Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics. No. 5. Cytological Studies in Cotton. I. The Mitosis and Meiosis in Diploid and Triploid Asiatic Cotton. A. Skovsted. 1933. Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 4. Studies on the Transport of Carbohydrates in the Cotton Plant. Part III. E. Phillis and T. G. Mason. 1933. Price **2s. 6d.,** post free.

" Reports received from Experiment Stations, 1932–33." Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology. No. 5. Further Studies on Transport in the Cotton Plant. I. Preliminary Observations on the Transport of Phosphorus, Potassium and Calcium. II. An Ontogenetic Study of Concentrations and Vertical Gradients. T. G. Mason and E. J. Maskell. 1934. Price **2s. 6d.,** post free.

* Out of print.

List of Publications—*continued.*

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics No. 6 (*a*). Further Experiments on the Inheritance of the Crinkled Dwarf Mutant of *G. barbadense.* S. C. Harland. (*b*) Two Interspecific Hybrids between Asiatic and New World Cottons. A. Skovsted. 1934. Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series A. Genetics No. 7. The Inheritance of Leaf Shape in Asiatic *Gossypiums.* J. B. Hutchinson. 1934. Price **2s. 6d.,** post free.

" Memoirs of the Cotton Research Station, Trinidad." Series B. Physiology No. 6. Studies on the Transport of Nitrogenous Substances in the Cotton Plant. Part VI. " Concerning Storage in the 'Bark." T. G. Mason and E. Phillis. 1934. Price **2s. 6d.,** post free.